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THE
Journal of the Society of Arts,
AND OF
THE INSTITUTIONS IN UNION.

110th Session.] FRIDAY, DECEMBER 4, 1863. [No. 576. Vol. XII.

Announcements by the Council.

ART-WORKMANSHIP.

The works submitted in competition for the Prizes offered by the Society amount to seventy in number, and are now placed for the inspection of members and their friends, in the Society's Great Room, where they will remain until Christmas, when, with the view of their being exhibited to the general public, they will be removed to the South Kensington Museum, by permission of the Science and Art Department. The works are as follow:—

1. *Modelling in Terra Cotta, Plaster, or Wax.*

(*a.*) The Human Figure in bas relief, after Rafaelle's design of the "Three Graces."—23 works.

(*b.*) Ornament in bas relief, after arabesques by Lucas van Leyden, 1528.—8 works.

2. *Repoussé Work in any Metal.*

(*a.*) The Human Figure as a bas-relief, after Rafaelle's "Three Graces."—3 works.

(*b.*) Ornament, after a Flemish salver in the South Kensington Museum, date about 1670.—1 work.

3. *Hammered Work, in Iron, Brass, or Copper.*

Ornament, after an iron German arabesque, about 1520, in the South Kensington Museum.—2 works.

4. *Carving in Ivory.*

The Human Figure in bas relief, after a terra cotta ascribed to Luca della Robbia, about 1420, in the South Kensington Museum.—4 works.

5. *Chasing in Metal.*

(*a.*) The Human Figure, after a reduced copy of Gibson's Psyche.—6 works.

(*b.*) Ornament, after a bronze plaque in the South Kensington Museum.—11 works.

6. *Enamel Painting on Metal, Copper, or Gold.*

(*a.*) The Human Figure, after Rafaelle's design of the "Three Graces," executed in grisaille.—None.

(*b.*) Ornament in grisaille, after a German arabesque, 16th century.—1 work.

7. *Painting on Porcelain.*

(*a.*) The Human Figure, after Rafaelle's "Boy bearing Doves," in the cartoon of the "Beautiful Gate."—5 works.

(*b.*) Ornament, after arabesques by Lucas Van Leyden, 1528.—3 works.

8. *Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.*

(*b.*) Ornament, after a majolica plate in the South Kensington Museum, 1490.—2 works.

9. *Engraving on Glass.*

(*b.*) Ornament, after arabesques by Lucas Van Leyden, 1528.—None.

10. *Embroidery.*

Ornament, after a German example in the Green Vaults at Dresden.—1 work.

The Council have requested Mr. Richard Redgrave, R.A., Mr. Digby Wyatt, M.R.I.B.A., and Mr. John Webb to act as judges in awarding the prizes.

The Council, considering the shortness of notice given to competitors, and the difficulties of making the subject sufficiently known, view the present as a satisfactory beginning, and they have re-appointed the Committee to consider the preparation of conditions for the next competition.

EXAMINATIONS.

The Local Board of the Polytechnic Institution has offered to give a prize of £3, provided the subject of Italian be included in the Examination Programme, and a suggestion has been made that Geology might also be advantageously added to the list of subjects. As the Programme for 1864 has already been issued, the Council are unable to make any addition to it, but they would be glad to know the opinions of Local Boards as to the advisability of adopting either or both these suggestions in a future year.

Wednesday evening Meetings previous to Christmas. Chair taken at 8 o'clock.

Dec. 9.—"Agricultural Progress: its Helps and its Hindrances." By J. Chalmers Morton, Esq. On this evening John Grey, Esq., of Dilston, will preside.

Dec. 16.—"On the Economic Value of Foods, having special reference to the Dietary of the Labouring Classes." By Dr. Edward Smith, F.R.S.

Courses of Lectures (under the title of "the Cantor Lectures") on the following subjects, will be delivered during the Session:—

The Operation of the Present Laws of Naval Warfare on International Commerce. By G. W. Hastings, Esq., Barrister-at-Law.

Fine Arts Applied to Industry. By W. Burges, Esq.

Chemistry Applied to the Arts. By Dr. F. Crace Calvert, F.R.S.

The following is the syllabus of Mr. Hastings' Course, which will consist of four lectures :—

Subjects of the Two Lectures on Dec. 7th and 14th, at 8 o'clock.

Nature and Objects of Public International Law.

Its Connexion in the Interests of International Commerce.

The Law of Naval Blockade, its Origin, History, and Present Condition.

Its Effects on International Commerce.

Arguments for and against the continuance of Commercial Blockades.

Subjects of the two concluding Lectures to be delivered after Christmas.

Contraband; its Nature and Usages.

Capture of Private Property at Sea; present State of the Law as modified by the Declaration of Paris; Arguments for and against its Continuance.

The Foreign Enlistment Act; its Operation on Commerce.

Proceedings of the Society.

Third Ordinary Meeting.

Wednesday, December 2nd, 1863; Dr. W. A Miller, F.R.S., Professor of Chemistry, King's College, London, in the chair.

The following candidates were proposed for election as members of the Society:—

Atkinson, George, 2, Highbury-park, N.
Baker, Edward, 36, Great Ormond-street, W.C.
Baring, Thomas, M.P., F.R.S., 41, Upper Grosvenor-street, W.
Blackburne, Rev. Thomas, Club-chambers, 15, Regent-street, S.W.
Buckland, Wm. John, Drummond-chambers, John-street, Adelphi, W.C.
Cook, Henry, Cannon-road, Brighton.
Engel, Louis, 31, Grosvenor-street, W.
Enkyn, Roger, 13, Upper Grosvenor-street, W.
Hammond, C. D., M.D., 11, Charlotte-street, Bedford-square, W.C.
Heaton, Charles, Bradford-house, Bolton.
Hill, John, 19, Tavistock-square, W.C.
Holtum, William, Church-street, Walmer.
King, William D., 148, Queen-street, Portsea.
Lewal, Gabriel, 5 and 6, Philpot-lane, E.C.
Martin, Henry A., 64, Berwick-street, Oxford-street, W.
Robinson, Vincent J., Douglas-villa, Carlton-hill, N.W.
Rogers, E. S., Victoria Oil Works, Collyhurst-road, Manchester.
Schiele, C., 2, Clarence-buildings, Booth-street, Manchester.
Sturman, Edward Albert, Camden-house, Sydenham-park, S.W.
Weatherley, Christopher, 39, High-street, Wapping, E.
Yates, W. S., Stamford-street, North-street, Leeds.

AND AS HONORARY CORRESPONDING MEMBER.

Kelaart, William Casper, Trinidad.

The following candidates were balloted for, and duly elected members of the Society:—

Adams, Benjamin, Bank of England, E.C.
Aitchison, David, 180, Piccadilly, W.
Bachhoffner, Dr. George Henry, F.C.S., 204, Marylebone-road, N.W.
Bagshaw, William E., 3, Compton-terrace, Islington, N.
Baker, George, 8a, Lucknow-terrace, Bayswater, W.
Ball, Walter F., 3, St. John's-park-villas, N.W.
Bankart, James, 10, Trinity-square, S.E.
Bass, Michael Thomas, M.P., 19, Lower Belgrave-street S.W.; and Rangemore, Burton-on-Trent.
Berrall, Wm., 39, Bedford-street, Covent-garden, W.C.
Bewick, Thomas John, Allenheads, Northumberland.
Blackbourn, John, 6, Trinity-terrace, Trinity-square, Brixton, S.
Blockley, John, 2, Park-road, Haverstock-hill, N.W.
Blyth, Alfred, 38, Westbourne-terrace, W.
Boehm, J. Erasmus, 28, Brompton-crescent, S.W.
Bond, Francis T., M.D., Hartley Institution, Southampton.
Bowkett, Thomas E., 2, Folkestone-terrace, Poplar, E.
Bowman, Robert, 10, Church road West, Islington, N.
Boyd, Dr., 10, Norfolk-terrace, W.
Bryson, John Miller, 57, Roupell-street, Lambeth, S.
Buckland, Francis T., M.D., 156, Albany-street, N.W.
Burgh, Nicholas, 78, Waterloo-road, S.
Burnell, Edward H., 32, Bedford row, W.C.
Burt, Major Thomas Seymour, F.R.S., 18, Wilton-place, Regent's-park, N.W.
Busher, Edward D., 11, St. Leonard's-terrace, Chelsea College, S.W.
Bussey, Geo. G., 14, Eton-villas, Haverstock-hill, N.W.
Butler, Charles, F.R.G.S., 13, Sussex-sq., Hyde-park, W.
Butt, I., Q.C., M.P., 8, Broad Sanctuary, Westm., S.W.
Buttery, Charles, 173, Piccadilly, W.
Cardwell, Reginald, 11, Cromwell-place, South Kensington, W.
Chorley, Thomas Fearncombe, 48a, Moorgate-street, E.C.
Clark, Edward Rawson, Drayton-villa, West Brompton, S.W.
Cleland, W., 24, Circus-road, St. John's-wood, N.W.
Coe, Ernest Oswald, 7a, Brook-st., Grosvenor-square, W.
Cole, Edward S., 6, Thurloe-place, Brompton, S.W.
Collinge, Arthur, C.E., 10, Marlborough-place, Kennington, S.
Cooke, Christopher, 13, Chatham-place, E.C.
Cooke, Major Anthony, R.E., 95, Mount-street, Grosvenor-square, W.
Cope, William, 26, Gloucester-cres., Regent's-park, N.W.
Corderoy, George, 17, King William-street, Strand, W.C.
Corderoy, John, 3, Kennington-green, S.
Cronmire, John Martin, 10, Bromehead-street, Commercial-road-east, E.
Currie, Edmund Hay, Bromley, Middlesex, E.
Davis, Matt. Boulton, 22, Buckingham-st., Strand, W.C.
Dunn, Spencer, 10, King-street, Finsbury, E.C.
Emly, Samuel Frederick, 12, Norfolk-st., Strand, W.C.
Evans, John E., 6, Albion-road, Hampstead, N.W.
Evans, John Hilditch, 60, Bartholomew Close, E.C.
Faulkner, John, 2, Mornington-crescent, N.W.
Field, Sidney, Northcote, Reigate.
Fisher, Joseph, Great Western Railway Station, Paddington, W.
Fletcher, Isaac, Tarnbank, Workington.
Greig, Alexander M., Ranelagh-road, Pimlico, S.W.
Guye, Auguste, 8, Guildford street, Russell square, W.C.
Hammond, Edwin, 23, Hamilton-street, Camden-town, N.W.
Harris, Wm. H., F.C.S., 33, Gold-street, Northampton.
Hewitt, Jonas B., 5, Angel-court, E.C.
Highton, T. Charles, 32, Norfolk-street, Strand, W.C.
Hill, Nicholas Stanton, Liverpool.
Hunter, Christopher, 34, Penton-street, Pentonville, N.
Kayess, William Henry Tucker, 23, Milk-street, E.C.; and Forest-hill, S.E.
Kindersley, Septimus Wigram, 38, Chapel-street, Belgrave-square, S.W.
Lorberg, W., Ph. D., 4, Wyld's-rents, Bermondsey, S.E.
Maclean, William, Grove-hill, Camberwell, S.
Marsden, Joseph Daniel, Edmonton, N.
Martin, Charles, 11, Langham place, W.

Michael, Jacob, Southfield-lodge, Southfields, Wandsworth, S.W.
Middleton, James, 2, Brook-street, Gloucester-place, W.
Oakley, William, High-street, Bromley, E.
Potter, William, 10, St. John's-wood-park, N.W.
Punshon, Rev. Wm. Morley, M.A., 8, Arundel-square, Islington, N.
Purdue, Thomas, Witney, Oxfordshire
Randell, Charles, 51, Rutland-gate, S.W.
Rucker, Martin Diederich, 115, Leadenhall-street, E.C.
Sabine, Robt. 39, Bessborough-gardens, Belgrave-rd. S.W.
Shaw, James Veitch, The Elms, Twickenham, S.W., and Knight Rider-street, Doctors' Commons, E.C.
Stubbs, John Heath, Bennett's-hill, Birmingham.
Smith, Edward, M.D., F.R.S., 16, Queen Anne-street, Cavendish-square, W.
Tatam, William, Langriville, Boston, Lincolnshire.
Taylor, Walter, Ranelagh-road, Pimlico, S.W.
Tupp, John, 27, Oxford-street, W.
Tylee, John, Bridge-street, Bath.
Watt, James, Caithness, Pavement Quarries, and Mount Pleasant, Thurso, N.B.
Weir, Edward, 142, High Holborn, W.C.
White, George, 70, Russell-square, W.C.
Winter, James, 100, Wardour-street, W.
Wolff, Sir Henry Drummond, K.C.M.G., The Albany, W.

The Paper read was—

ON MAGNETO-ELECTRICITY, AND ITS APPLICATION TO LIGHTHOUSE PURPOSES.

By F. H. Holmes, Esq.

As this is a paper on the Application of Magneto-Electricity to Lighthouses, I will begin by saying a few words on lighthouses themselves, their former and present state, and the systems now generally followed in the arrangements for lighting.

Formerly lighthouses were very few, and were nearly all coal fires on high cliffs or towers, and most of them were the property of private individuals; but, as shipping increased, so the lighthouse system became more and more developed, both in the number of lighthouses and in the improvement of those already existing. The coal fire gradually gave way to the oil lamp and candles; next we find the introduction of spherical mirrors or reflectors, and these, again, were superseded by parabolic reflectors, sometimes to the number of more than thirty in one lantern. After this came the introduction of the "Fresnel Lens," which took the place of the reflectors and their lamps, however numerous they might be, and required instead one central lamp.

This "Fresnel Lens" has again grown, so to speak, larger and larger, as the want of a more powerful light was felt, till it has now a diameter of six feet and a height of ten, for to increase the quantity of light the size of the lamp must be increased, and the lens in proportion, or it would have been so far out of focus that the intention of the lens would have been frustrated.

To make these progressive improvements in lighthouses vast sums of money had to be expended; and now let us see what was the end sought. First to improve the light itself. This is done by the substitution of a lamp of four concentric wicks, the largest nearly four inches in diameter, for the coal fire. If the improvement had stopped at that it would have been small indeed, but this lamp is more under command than the coal fire. The value of the introduction of oil is not so much, then, on account of its greater power as for its aptitude for the employment of economising apparatus, whether this consists of reflectors or lenses. All incandescent bodies give out rays as it were from the centre to the circumference of a sphere; of such rays only those which fall on the sea would be useful to the mariner, but by means of reflectors those rays which would pass inland, or upwards, or downwards, are reflected towards any required point, and by a proper arrangement of a series of reflectors, the whole or nearly the whole of the rays are directed where required. The Fresnel lens consists of a middle refracting belt, and a double series of reflecting prisms, or zones, as they are generally termed, and, when properly constructed, it has the property of collecting all the rays into one horizontal beam, so that all the light from the lamp is utilised. Thus, then, we see great strides have been made, since the introduction of oil lamps, as regards the lenticular apparatus—in fact that may be said to be nearly perfect; let us then return to the consideration of the light itself for a moment.

Whether a large or a small lamp be employed it will make no difference in misty weather, so long as the thickness of the flame is the same, for a large lamp may be equal to ten or twelve smaller ones, and, if replaced by these ten smaller, it will be evident that when one of these is obscured by mist the whole of them will be obscured. Quantity of light, then, will not add to its power of penetrating mist. By making the large lamp with four concentric wicks, the intensity of the light is a little increased, and such a lamp will penetrate further through mist in a slight degree. But it is in misty and hazy weather that the light is most required; hence, now that everything else is nearly perfect in a lighthouse, the authorities, both in this country and elsewhere, are directing their attention to the only thing wanting to make the whole system perfect, that is, a light capable of penetrating mist; and as this power depends on the intensity of the light, and electricity is capable of producing the most intense light known, it was naturally looked to as the possible means of perfecting the whole system. But the light produced by electricity to be applicable for lighthouses must be certain and constant, not liable to extinctions or any great variations, as the first would tend to endanger vessels seeking and not finding the light; and if a fixed light had much variation, it might be mistaken for a revolving light.

Let us now see whether electricity can produce a constant steady or uniform light. Frictional electricity will give a succession of flashes intensely vivid, and might be used for the purpose, but for the fact that the slightest moisture is sufficient to convey the whole charge to the earth. The various forms of galvanic battery are all capable of producing a steady and intense light, but still (besides the great expense) they are not applicable, because of the necessarily varying current, which becomes weaker and weaker as the solution becomes saturated. The magneto-electric machine is then the source from which one would naturally expect a light which should be invariable in its nature, and capable of being continuous for any given time, as the current produced bv this machine is constant as long as the helices revolve with the same speed, and the speed can be easily regulated to any required velocity.

The electricity derived from a magneto-machine is induced in coils of wire, by the changing of the magnetic polarity of pieces of soft iron inclosed within the coils or helices; and the quantity or intensity of the induced current depends first, on the amount of magnetism induced in the soft iron; secondly, on the facility with which the poles of the magnetised soft iron can be reversed; thirdly, on the velocity with which the change of polarity takes place; fourthly, on the length and diameter of the wire forming the helices.

The amount of magnetism induced in the soft iron depends on the size and force of the steel magnets employed, and on the weight and softness of the iron in the helices; but the weight in practice of the soft iron is limited by the weight of the steel magnets, for, if too heavy, the steel magnets will be slowly deprived of their magnetism. To facilitate the change of the poles the soft iron cores of the helices are not solid pieces of iron, but are tubes, single, double, or treble, as it is found by experiment that the same weight of iron, when divided in this manner, loses or takes magnetism in much less time than when in a solid form.

There is a limit to the velocity to be employed when the maximum of electricity is required, for this reason. It has been already remarked that the amount of electricity depends on the amount of magnetism taken up, and that the soft iron takes time to become saturated, as it may be termed, with magnetism; hence, if the velocity be too great with which the cores move from one pole of a magnet to another, there will not be sufficient time for the cores to become saturated. But as again the quantity of electricity increases as the velocity increases, it is necessary to ascertain this maximum point exactly, which is easily done, either by experiment or calculation, based on certain data. The length and diameter of the wire require to be different, according to the current required; for a short thick wire forming the helices represents a galvanic battery composed of a dozen, say, of very large pairs of plates, whilst a long thin wire would represent a battery composed of thousands of small plates. In other words, supposing the size of the helices to remain the same, if they are composed of thick short wires, quantity is obtained; but if composed of long thin wires, intensity will be the result.

From all this it results that there are certain laws known and established, by which a magneto-electric machine can be made to give a current of any given amount of electricity, with any given ratio between its quantity and intensity.

Having seen on what the production of the current depends, the next point to observe is, the peculiar nature of this induced current. It differs essentially from a galvanic current in this, that while the helices are revolving, the direction of the current is reversed, as the core of soft iron passes each consecutive pole of the steel magnets.

It now remains to explain how the current generated in the wires of the helices is to be withdrawn from the machine. In the first place all the helices are connected in two, or four, or more series, and in doing this great care must be observed that the direction of the coil of every alternate helix is in an opposite direction, that is, if one is wound as a right-hand screw, the next should be as a left-hand screw, or, what amounts to the same thing, supposing all wound in the same direction, then the two inner ends of the wires must be joined of, say, numbers one and two, and the two outer ends of the wires of number two and three, and so on through the series; and lastly, the terminals of the series might be soldered into two insulated discs, and then led from the machine by two pieces of metal kept in contact with the outer surfaces of these discs by a slight spring; such an arrangement allows the alternating current to pass from the machine, and such a current will produce a light, but this light has certain disadvantages. It is never white, but always more or less blue or brownish; in fact it is like the electric light obscured by placing it behind a flame from spirits of wine. It is also extremely injurious to the eyes, both from its colour and its tremulousness; I therefore do not use this current, but in its stead I convert this constantly-inverting current into two that flow from the machine in one direction only. This is accomplished thus: One half of the helices are arranged so as to arrive on the poles of the magnet at the instant that the other half are exactly midway between the poles. Thus there are two distinct currents; and what may be called the dead point, that is the point when the current inverts in one series, occurs exactly at the time when the other current is at its maximum, so that if now the inverted currents can be again inverted in both of these distinct currents, and that the two now flowing in one direction can be united as one compound current, it is evident that the result will be a current nearly as uniform as that from a galvanic battery, with the advantage of equable continuity. This is done by the two commutators, which consist each of two insulated rings of metal, of such a form at the periphery that two rollers or rubbers change sides from one disc to the other at the same instant that the current is reversed. Then, by combining the two commutators, a compound current is obtained that will produce a constant white light or perform any of the other functions of the galvanic current, and in a more perfect manner, as it is more uniform in its action.

A steady and constant current thus obtained from the magneto-electric machine is only one part of the problem of producing a constant and steady light, and, although the most important part, still it would be perfectly useless without an efficient lamp or regulator. In order to understand this it is necessary to explain that the carbon points used for producing the light or for converting a portion of the electric current into light, are consumed, and that the rate of consumption is irregular, owing to the irregularities in the structure of the substance used, which is the kind of graphite deposited in the gas retorts sawed up into pencils about a quarter of an inch square; but, as the consumption is irregular, no clockwork with continuous motion could be employed for the purpose of causing the carbons to approach as consumed, for it must be understood that the steadiness of the light as well as its brilliancy depend on the two carbon points being maintained constantly at a certain distance corresponding to the strength of the electric current.

Many pieces of apparatus more or less complicated have been invented from time to time for the purpose of regulating the movements of the carbon electrodes, and many of them I have tried, but none of them, as formerly constructed, could be used in a lighthouse, bcause they were more or less uncertain in their action, and because the clockwork was too delicate and liable to accident in other hands than those of an electrician. The question, what constitutes a good regulator, must be answered by stating what it must accomplish; and moreover it must perform its several functions in the most simple manner. It must in the first place maintain the carbons at a given distance, whatever be the variation in the state of consumption, and must also be capable of being adjusted to any strength of current; secondly, if by any accident the current should be interrupted, and the light thereby extinguished, the regulator should be capable of relighting at once with full brilliancy, that is, not only must it allow the carbon points to touch to re-establish the current, but must separate them again instantly, or there would be no light. Such a regulator we have here, for its construction is simple, and it forms its different functions in a most perfect manner. Its construction is this. The upper carbon is attached by a kind of small vice to a bracket, standing out from a tube, which slides freely in a column. The lower carbon is fixed in the end of another tube, exactly under the other carbon. Both of these tubes are put in motion thus: Two cords, passing over pulleys, properly arranged, are wound on one spindle, but in opposite directions. On turning a stud fixed on the end of the spindle the regulator is wound up; that is, the top bracket is raised, and the lower tube depressed. On removing the hand from the stud, the upper tube would descend, and, being loaded, would cause the lower tube to rise; but to prevent this, while the regulator is out of use a bolt is pushed in, which prevents any movement in the regulator till it is again withdrawn. The regulator being wound up, the carbons are firmly fixed in their places by tightening the holders, and are then adjusted so as to bring the points in the focal plane by turning a spindle to which the fixed end of the cord belonging to the lower carbon is attached. So far the regulator is only a means by which the carbons can mutually approach each other with a certain relative speed, depending on the different diameters of the two parts of the spindle around which the cords are wound. But if the carbon points remain in contact, there will be no light. Some contrivance, then, was necessary to separate the points to the distance, which, by experience, is found to give most light, and to maintain that distance between the points constantly till the whole of the pair of the carbons is consumed. These two operations are accomplished thus. The fixed end of the cord which works the upper carbon is attached to one end of a lever; the other end of the lever has a piece of soft iron attached to it, over an electric magnet, so that when the bolt is withdrawn, and the carbon runs together until they touch (thus allowing the current to pass), this electro-magnet instantly, by the action of the same current, lifts the cord, and with it the upper carbon, to the required distance. But this is not all, for the carbons would again run together were there not some contrivance to prevent them. To accomplish this, advantage is taken of these two facts—first, that the quanity of electricity is proportional inversely to the distance between the carbon points; secondly, that the strength of an electro-magnet is proportional to the quantity of electricity passing through the wire that surrounds it. Bearing these two facts in mind, it will be easy to understand the use of the second electro-magnet. Over this electro-magnet, at a small distance above it, is placed a lever, one end of which is drawn down by a spring, the strength of which can be regulated by a thumb-screw. The fulcrum is between this end and the centre. The other end of the lever is furnished with a catch, and immediately over the electro-magnet a piece of soft iron is fixed in the lever. On the carbons being allowed to touch as before, not only are they separated by the means described, but this second lever, acted on by its electro-magnet at the same instant, is drawn down towards it, and thus brings the catch between the teeth of a wheel placed under it for the purpose, and effectually locks the regulator. The strength of the spring is now adjusted till its tendency to lift the catch out exactly balances the current which draws it down. Should the distance now increase but the $\frac{1}{200}$ of an inch, the spring will be stronger than the current, will lift the catch, and the carbons will approach; but by doing so more current passes, the electro-magnet is strengthened, and is again enabled to overcome the spring and draw down the catch, and thus by their mutual action the distance between the carbon points is all but invariable.

When these regulators are employed in a lighthouse there are a pair for each lens and two small lenses, so that although it may take ten minutes to replace the consumed carbons, still the light is never extinguished; for, suppose the carbons consumed in the lens No. 1, the regulator is ready in lens No. 2; and all the light-keeper has to do is to bolt the No. 1 regulator and draw the bolt of the regulator in No. 2 lens; the current is thus diverted, No. 2 is instantly lighted, and the lighting of this extinguishes No. 1.

Thus, then, we have a most intense light, which may be maintained for any length of time, which does not require to be trimmed or extinguished for a second, and which has all the steadiness and uniformity required for lighthouse purposes. Its advantages over the oil lamp are: first, its power can be increased *ad libitum* without increasing the size of the lens, for, if required, a machine may be made to give light enough to read by say at 10 or 20 miles; in fact the light is in direct proportion to the power of the machine that produces it; secondly, its great intensity gives it a power of penetrating haze only equalled by the sun; thirdly, its whiteness distinguishes it most perfectly from all other lights on shore, which is one of its most important properties, for many a vessel has been lost for want of this property in lighthouses lighted with oil; fourthly, where coloured lights are required for the purpose of distinguishing one lighthouse from another, this light gives all the colours in a perfect manner, while the oil lamp always gives its own tinge to the colour employed; fifthly, from the facility with which this light can be extinguished in an instant, and as instantly lighted to its full power, it offers other means of distinguishing lighthouse from lighthouse which cannot be obtained with any other light. The importance of this may be understood from the fact that there are still many points around our shores that require lighthouses, but which must remain without them, till better means of distinguishing them with certainty from others in the immediate neighbourhood can be employed; for having no lighthouse is hardly worse for the navigator than having two in sight which cannot be distinguished one from the other.

An objection has been made to this light, that, being so small, it would be altogether invisible at a considerable distance; and when we merely consider that the apparent size of distant objects depends on the visual angle, there seems to be some ground for the objection, but the law of visual angles does not apply in the case of self-luminous bodies, as can be demonstrated with this piece of fine wire, which I suppose is almost invisible even with a strong light thrown on it, but now, if by passing a current of electricity through it it is made self-luminous, it appears gradually to increase in diameter as it becomes brighter; and as a curious fact, illustrating the difference between the theorist in his study and the practical observer, a sailor who had seen the magneto light from a great distance told me he supposed it must be at least ten feet in diameter. Another objection to the light is, that it is too bright; this may be an inconvenience in clear weather, but a light to be useful when most needed must be inconveniently bright in clear weather.

The last point to be considered is the cost of the magneto electric light as compared with oil. The French director-general of lighthouses has made a report to his government, both as to first cost and as to cost of maintenance; both are greatly in favour of the magneto-electric light; of course in making their calculations of cost, they take the cost of an equal quantity of light in each case, that is, by oil and electricity.

I have now only to remark that this invention, if it may be called one, is purely English; Faraday commenced it when he discovered the fact that magnetism might be made to produce or induce an electric current; and although the magneto-light was first produced in Paris, it was by me; and so far from receiving assistance from any of the French *savans* in the matter, I was ridiculed by all of them for attempting what they said they could demonstrate was impossible. With regard to the regulator, which is also invented by me, there is another just invented by a Mons. Foucault, on a very different principle, but which is quite as effective though overloaded with clockwork. His regulator has this peculiarity, it can be used in a rolling vessel, and will bear with impunity the vibrations of a steamer.

DISCUSSION,

Mr. Lawrence suggested that Mr. Holmes should give a description of the practical arrangements of his apparatus at Dungeness lighthouse.

Mr. Holmes stated that at Dungeness, where the light had been in constant use since the 6th of June, 1862, there were in the lantern two small lenses, fixed one over the other, and two regulators to each. Only one light was shown at a time, but there were two regulators for each lens, so that an instantaneous change from one to the other could be made without extinguishing the light when fresh carbons were required. In the machine-room there were two magneto-machines, each capable of giving a powerful light, though both were in constant use. There was a distinct direct-acting steam-engine attached to each machine, and there were two Cornish boilers, each capable of generating steam enough for the two engines. The material consumed at Dungeness was about 30 to 35 lbs. of coke per hour, and 5½ inches of graphite in the regulator per hour, the price of this last being under three farthings per inch. The principal item of expense was, at present, the engineer, who had charge of the whole apparatus, but he expected that when there were several lighthouses on this principle, it would be found that one engineer would be sufficient for as many as were at present under the charge of an agent, and that none but stokers and lightkeepers would be required on the spot. The magneto-electric machines which were at Dungeness contained 120 horseshoe magnets of about 50 lbs. each, and 160 helices, but those which he now constructed contained only from 66 to 70 magnets, and from 88 to 120 helices.

The Chairman said he had listened with much pleasure to Mr. Holmes's very clear statement. He was glad to see present Dr. Gladstone, a member of the Lighthouse Commission, and he hoped that gentleman would favour the meeting with some remarks tending to illustrate this subject, which was one of national importance. It was most interesting to know that the little electric spark, not bigger than a pin's head, obtained by Faraday from the magnet not very many years ago, should have led to this development of power in the hands of an able and ingenious man like Mr. Holmes.

Mr. Summerlin referred to an invention of a somewhat similar character, by M. Berlioz, which, he believed, was superior to Mr. Holmes's apparatus. He would have been glad if Mr. Holmes had given some description of it.

Dr. Gladstone, F.R.S., said, as his name had been mentioned by the Chairman, he could not but rise to bear testimony to the able manner in which Mr. Holmes had brought forward this subject. During the existence of the Royal Commission, he had an opportunity of frequently witnessing the experiments made with this apparatus at the South Foreland. The Commissioners afterwards examined everything connected with the lighthouse system in France, where, at that time, when this brilliant light had been burning for half a year at the South Foreland, they were still making preliminary experiments, for they had not then overcome the irregularity of the current of electricity, and could not get a steady light. Since then they had advanced very rapidly, and orders had been given to place a double light of this description at Cape La Hève, near Rouen. The Dutch might perhaps be considered to have been before the French in the adoption of this system, and the Emperor of Brazil was probably before either. He did not think Mr. Holmes had exaggerated the power of this light, or the ease with which it was managed, and he was glad to be able to say this, because they knew that an inventor, justly proud of his child, was often unconsciously disposed to give the best possible account of it. He was very glad to hear what Mr. Holmes had said with reference to the expense of an engineer being divided amongst several lighthouses, because that was the main difficulty. When the complexity of an instrument was increased, more skill was required in its management, and this necessarily led to expense. The great desideratum was to have a light which was capable of penetrating to great distances in misty or rainy weather, and in that respect this light was far superior to the Fresnel lamp, which was quite competent to send a light to the extreme horizon on a clear night. In a dense fog no light whatever was of any use; but a mere mist, or a shower of rain, the electric light could penetrate. There was abundant testimony that the lights at Dungeness and the South Foreland had been seen by the captains of steamers crossing from Folkestone to Boulogne, at a far greater distance than an ordinary oil lamp. Moreover, the intensity of this light could be augmented to any extent. Professor Faraday, in his reports to the Trinity House, had laid great stress upon this. All that was necessary was to double the number of magnets, and practically this was easily done, because there were duplicates of everything in such lighthouses, and in foggy weather it was possible to bring the power of both machines to bear upon one instrument; and in that way double the intensity of light could be obtained. Then further,—supposing the fog to be so dense that no light could penetrate it, the steam engine on the premises might be employed to blow a horn or whistle, or to make some other noise which would serve as a direction to vessels. This had been pointed out by M. Regnault, director of lighthouses to the French Government, and was of great importance at a time when the question of fog signals was attracting so much attention.

Dr. Bachhoffner said, having been engaged in most of the patents taken out for producing the electric light, he had some little knowledge of the difficulties which had hitherto been considered almost insurmountable in producing the results which had been shown this evening. The great merit of this plan was the particular mode in which the electric light was obtained, and in this respect, as far as he had seen, Mr. Holmes had displayed a great amount of ingenuity. He confessed, when he first heard that Mr. Holmes had taken this matter in hand, he was very sceptical of his success; he did not believe that so much electric force could be obtained by the magneto-electric machine. The ingenuity displayed was very great, particularly in estimating the exact quantity of iron necessary for the core. Some years ago he (Dr. Bachhoffner) was engaged in some experiments on this subject, but he used iron wire instead of a hollow core. Mr. Holmes had spoken of the existence of liquid carbon between the two points, but this he (Dr. Bachhoffner) would be glad to have more evidence of. In using the electric light there was a deposit on one of the carbons, and with coke points pure graphite was produced, but he had great doubts as to the fact of liquid passing between the two points. A perfect automatic machine for regulating the position of the points was essential, and Mr. Holmes had mentioned that a spring formed part of this apparatus. He (Dr. Bachhoffner) was sorry there was any spring at all, or even clockwork. He thought a lamp might be constructed without a spring, and that would, in his opinion, make the machine perfect. The ingenuity displayed by Mr. Holmes up to this point would, no doubt, enable him to make an improvement in this respect. With regard to the question of cost, he did not think either the oxy-hydrogen light or the electric light would ever be useful for purposes of general illumination, for in such cases the cost of the light was a most important consideration, but for lighthouse purposes this ought not to be regarded, because the matter involved the safety of human life. Nevertheless, it would be interesting to know what was the cost of this system, light for light, as compared with other methods. He congratulated the public, the seafaring portion of it in particular, upon this valuable application of electric power, which at one time he thought hardly possible of accomplishment.

Mr. Holmes said the cost of this light compared with oil had been gone into by Mr. Regnault, director-general of lighthouses in France, and he had calculated very fairly on the principle of light for light, and, reckoning in this way, including the expenses of alteration, taking down the large lens and putting in two smaller ones, putting up the apparatus, two steam engines complete, and the buildings to contain them, the whole of the cost was calculated at half that of an ordinary first-class lighthouse, light for light. They would quite understand the actual expense was greater than in an ordinary lighthouse, but when the quantity of light was considered, it was less by one half, whilst the working expenses were only one-third. The light at Dungeness, he calculated, was equal in quantity to 14 of the large oil lamps with four concentric wicks. With regard to the intensity of the light, there was no form of combustion, and no chemical action which could produce a light—explosion was a different thing—beyond a certain amount of intensity. The greatest was that obtained upon lime, because the hydrogen and oxygen gases, burnt together, approached as nearly as possible to an explosion. With regard to the small size of this light, it might be argued that so small a light would become invisible at a great distance, say 30 or 40 miles. If an object three feet in diameter appeared to be only an inch at the distance of a mile, what must this little point of light be at a long distance? He admitted there was something in this argument when based on the theory of the visual angle only, but it did not apply to luminous bodies. [Mr. Holmes illustrated this by showing a thin wire, which was almost invisible till rendered incandescent by a current of electricity, when its apparent diameter was greatly increased.]

The Chairman said the next duty which devolved upon him was the agreeable one of proposing a vote of thanks to Mr. Holmes for his valuable paper. He was quite sure they had heard with satisfaction what had been stated by Dr. Gladstone, who had had opportunities of examining on a large scale the methods of illumination at present practised, and he was sure every remark from that gentleman would have great weight with those present. The power which this light possessed of penetrating to a great distance constituted its superiority to any system of lighting now in use; and it was to be borne in mind that that was dependent upon the extreme intensity of the heat evolved. It had been correctly stated by Mr. Holmes that of all the lights produced by chemical means, that of the combustion of hydrogen and oxygen gases upon a ball of lime was the most intense; but electricity was far more intense than any chemical action. By its means they could fuse the most refractory metals, and convert into vapour substances which could not be volatilised by other means. With regard to the precise condition of the carbon as it passed from point to point, there might be a difference of opinion. He thought it doubtful whether it was liquefied. He could corroborate the statement of Dr. Bachhoffner as to the complete conversion of the carbon into graphite when coke was employed. Mr. Holmes was greatly to be congratulated on the manner in which he had contrived to economise the power of his currents. He had by an ingenious method detected the means of indicating the exact quantity of magnetism residual in the magnet. Another curious result which Mr. Holmes's practical experience had enabled him to effect, was the proportioning the weight of the armature to the size of the steel magnet, so as to avoid diminishing its power. This was one of the most curious results in the science of magnetism that had been produced in the course of this enquiry. An opportunity had been presented to Mr. Holmes of making experiments on a grand scale, which could not be done in the laboratory of the chemist. The practical man followed the theorist, and hence there arose a harmonious co-operation between the two in the advancement of science. He congratulated the Society upon having had so valuable a paper brought before them.

The vote of thanks was then passed.

The paper was illustrated by a display of Mr. Holmes's arrangement of the electric light as used in lighthouses. Some reflectors and oil lamps were kindly lent by Mr. R. C. Wilkins, with the view of showing the various systems employed in lighthouses at different periods.

The Secretary announced that on Wednesday evening next, the 9th inst., a paper by Mr. John Chalmers Morton, entitled "Agricultural Progress: its Helps and its Hindrances," would be read. On this evening John Grey, Esq., of Dilston, will preside.

The following letter has been received:—

Sir,—In the discussion that took place on Mr. Holmes's valuable paper, Dr. Bachhoffner made a pertinent remark to the effect that while the magneto-electric arrangement for producing a continuous current of electricity was perfect, the lamp or automatic regulator was too delicate an instrument to place in the hands of such a workman as one might expect to find in a lighthouse, and that anything in the shape of a spring was to be avoided if it were possible. Now, although a cheap lamp is not a consideration for such an important object, a regulator of simple construction is much to be desired; for if a break-down were to occur during stormy weather, the ease with which repair can be effected would be a matter of the first importance. Now, the simplest form of electric light with which we are at present acquainted is that of Professor Way, for it mainly consists of a fine stream of fluid mercury flowing from an iron reservoir in connection with one pole of any arrangement that will give forth a current of electricity in one direction, such as we have in a Grove's or Bunsen's battery, or in Mr. Holmes's magneto-electric generator, into an iron reservoir in connection with the other pole of the arrangement, and at a certain point in the falling continuous stream of mercury, combustion of that very volatilizable metal occurs with the production of a very intense and peculiar blue light, which, from its characteristic aspect, is admirably adapted for signal or lighthouse purposes. Now, Dr. Gladstone informs me that the drawbacks to this arrangement are, that a small portion of mercurial vapour is *supposed* to escape from under the glass shade with which the light is protected, and that if a break in the fluid or current were to occur, the shade would become chilled (from the loss of heat on the cessation of the current) and the mercury be deposited in small globules, so as to veil the light for some minutes after the current and light were again established; for, when the shade is warm, the mercury flows freely down the sides of the shade, leaving the glass itself quite bright. I think a very little ingenuity would dispose of these faults in an arrangement that in other respects strongly recommends itself to consideration. If there are other faults, it would be as well that we should hear of them. But, besides this, there is another simple form of automatic lamp, furnished with the ordinary carbon points, the invention of my friend Dr. Squires, which is at once cheap and so free from complication, that it would be very difficult to put it out of gear. This was exhibited by me at the Polytechnic Institution at the trial of electric lamps, some time ago, and this roughly-made arrangement, costing scarcely two pounds for material and construction, held its own against the costly and complicated arrangements of Duboscq, Serrin, Ladd, Heisch, &c., inventions, by the way, admirably adapted for the niceties of the lecture-room demonstrating lantern. Thinking it right to let Dr. Bachhoffner and others interested in this important subject know that such a lamp as he indicates is in existence, I am, &c., SAMUEL HIGHLEY.

18, Green-street, Leicester-square, London, W.C.

Proceedings of Institutions.

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Banbury Mechanics' Institute.—The distribution of the certificates awarded by the Society of Arts took place on the 23rd of October, in the Town Hall. The Rev. H. Back, vicar of Banbury, took the chair. —The Chairman said he regretted there did not appear to be any great increase in the number of the students. There was no reason why such should not be the case, for though no doubt the examinations were strict, still most intelligent young men would be glad to continue their education themselves after they had entered upon the details of active business, and would rejoice in being able to satisfy both themselves and the examiners that they had really been able to do so.—Mr. Beale having read the list of successful candidates, Mr. Pidgeon addressed the meeting. He thought the results of the examinations were very satisfactory, and proved that the connection of the Mechanics' Institute with the Society of Arts had done considerable good to the education of the young men of Banbury. He took the opportunity of explaining the distinction between the Government Department of Science and Art and the Society of Arts, which were often confounded.—Mr. Samuelson, in proposing a vote of thanks to the Local Board, said that thanks were due in the first place to the Society of Arts itself, and to the founders of the system of examinations—a system which had since been followed up by the Oxford Middle Class Examinations, and still more recently by those of the Government Department of Science and Art at South Kensington. This was seconded by Mr. Brooks, and acknowledged by Mr. **Beale.** A musical performance was afterwards given.

Barnet Institute.—The fourteenth annual report says that, perhaps, on no former occasion, has there been greater cause for congratulation upon the success of the Institute. The Committee are happy to state that more general interest in the welfare of the society is manifested throughout the whole neighbourhood. The number of members upon the books is 190, being an increase of 50 added during the past season. The attendance upon the lectures last winter was considerably over the usual average. The library has received some valuable additions this year, and will be further improved shortly, as there is money voted for books which has not yet been expended. The Committee regret that more use is not made of the privilege of the Society of Arts Examinations. Three candidates only presented themselves this year. The Committee have done much in the formation of classes; but they have not been well supported. The funds are sufficient for present emergencies. The receipts were £101 4s. 2d., and there is a balance in hand of £19 2s. 4d.

Worcestershire Union of Educational Institutes.—The annual meeting of this body was held at Stroud on the 20th November, in compliance with an arrangement made last year, Gloucestershire having now joined in the Union. J. S. Pakington, Esq., President, was in the chair. The Rev. W. Walters, Hon. Sec., read the sixth annual report, which expressed the satisfaction of the Committee at the extension of the Union into Gloucestershire, and alluded to the vacancies in the committee, occasioned by death and removals. The Committee also recommended that in future there should be but one Hon. Sec., with a paid subordinate. The following shows the progress of the Union:—

	Institutes having Classes and Night Schools.	Pupils in Classes.
1858	8	342
1859	9	293
1860	10	697
1861	14	851
1862	20	1,457
1863	28	1,418

The report of the organizing master for 1863 showed the number of candidates to be steadily on the increase. This year it is 356, exceeding that of last year by 143. But he adds that, generally speaking, evening classes are not in a satisfactory state, and are not doing the good they are calculated to effect. Penny Readings had been established at Redditch with success. The book boxes had been steadily circulating, and the experiment of holding a meeting for the reading of papers on educational subjects had been successful. The report alluded to the establishment of the Metropolitan Association for Promoting the Education of Adults, and cordially wished it success. Under the auspices of the "Club and Institute Union" twelve new Institutes and Working Men's Clubs had been established in various parts of the kingdom during the past year. The finances of the Union are still too low to allow of anything but the most gradual progress. The statement of accounts shows the expenditure of the year to have been £76 9s. 5d., and that there is a balance against the treasurer of £4 1s. 6d. On the question of entertainments being introduced, Rev. H. **Solly** (Secretary of the Working Men's Club and Institute Union) spoke in favour of mixed reading and music, and theatrical entertainments, but said that the last-named were likely to lead them into legal difficulties. He urged that the great advantage of Saturday evening entertainments lay in the fact that they afforded the means of bringing the working classes, and among them the most well-to-do and respectable artizans, under many very beneficial influences, from which they had hitherto been almost entirely debarred. Mr. H. **New** (Evesham) read a paper on the engagement of a paid teacher, instead of a lecturer, by the Union. They had not, he said, at present, any system which made their classes of a permanent character. In looking at the report of the Yorkshire and East Lancashire Unions, he found that the former had an agent who went round visiting the Institutes, but in the East Lancashire Union he found something more strictly educational—that two skilled itinerant teachers went round and taught the local teachers to set the schools going. These masters visited Institutes five days a week, and lectured on the Saturday. Lectures were not the most important part of the scheme of an educational institute. If they wanted to find real education they must go into the class rooms and reading rooms.—The usual dinner was held in the Masonic Hall, some 250 people being present, S. S. Dickinson, Esq., President of the Stroud Institute, in the chair.—An evening meeting was held at which Earl Ducie presided. Sir **John S. Pakington**, Bart., delivered an address, in the course of which he deprecated the making recreation a primary object of an Institution, being of opinion that youth would find means of recreation; he also spoke against applying the word "club" to an Institution that had for its object the mental and moral improvement of the people, and in reference to the progress of education said that the other nations of Europe were ahead of us in educational appliances. In many of those countries the cultivation of the intellect of the working classes was better, more skilfully, and more successfully attended to than in our own country, and this was also the case in our colonies. Mr. J. S. **Pakington**, in proposing a vote of thanks to the Chairman, &c., said the meeting that day was the most successful that had taken place in connection with the Institution.

SCIENCE AND WAR.

The Duke of Cambridge and the Secretary of State have issued some important educational regulations which are well calculated to augment the connection of science with warfare, and to give an increased impulse to the improvement of our artillery corps, which ought to be equally as scientific as the Royal Engineers,. The early training of both corps is the same, and it might perhaps be well if they were amalgamated, so as to have the pick of the best men for those services in which they most distinguish themselves. 1. Provision is made for the future special instruction of officers who may desire to qualify themselves for employment in connection with the manufacturing departments, the civil establishments of the Royal Military Academy, and generally for all appointments usually held by officers, not being military staff appointments, which are special to the Artillery service. 2. By this arrangement the Royal Regiment of Artillery will continue to sustain its scientfic reputation under any progress which may be made in the mechanical arts as applied to *matériel* of war. 3. No officer will be permitted to compete for a place in the proposed class who has not given satisfaction in the discharge of his regimental duties, and is not, from a military point of view, an active and efficient artillery officer. 4. No officer will be admissible under six years' service, and he must have undergone a course of instruction at Shoeburyness. A medical certificate of good health will be required. 5. The first examination will take place in March, 1864, under the Council of Military Education. The books to be specially taken up, until further notice, are—*Twisden's Mechanics* and *Todhunter's Differential Calculus*, but the examination will be chiefly confined to the earlier portions of the latter. The French will be qualifying for the purpose of ascertaining that the candidate has such an acquaintance with the language, and especially with the technical terms in common use, to be able to consult professional works, such as Didion's *Traité d'Artillerie*, or the *Aide-Mémoire d'Artillerie*, with facility. 6. The relative importance to be attached to the subjects of examination will be as follows:—Differential and integral calculus, 700 marks; chymistry, physics, 300 marks;

French, qualifying. 7. The course of instruction will extend over two years, and embrace in succession the special duties of each manufacturing department. For example, in the Royal gun factories, metallurgy of copper, tin, zinc, and their compounds; mechanical and chymical properties of gun metal; metallurgy of iron, including cast-iron and wrought iron, steel, and their alloys; mechanical and chymical properties; principles of construction of cast-iron guns; principles of construction of built-up guns, welding, &c.; the steam hammer; turning, boring, rifling, and sighting guns; all the machines, lathes, special tools, and processes; comparison of systems of rifling and breech-loading for cannons; gauges and micrometrical measurements; organisation of labour in the Royal gun factories; system of account-keeping, pricing, and payment in the Royal gun factories; relations to the director of stores, director of contracts, principal superintendent of stores and director of ordnance; patterns, systems respecting them; examination of stores. 8. Duties of the Inspector of Artillery:—Proof of guns, examination of guns and stores. 9. The small arms departments, Enfield and Pimlico, will follow the Royal gun factories, and be treated in the same comprehensive manner, including the system of supply of small arms to the army, their repair, and comparison of systems of rifling and breech-loading for small arms. 10. From the Royal gun factories the class will proceed to the Royal carriage department, where the subjects will be,—selection and purchase of timber, seasoning of timber, saw-mills, planing and other machinery applied to working of timber; construction; mechanical principles as applied in military machines; friction, draught, traction, locomotive power; harness; organization of labour in the Royal carriage department; system of accountability and payment; prices; relations to director of stores, director of contracts, principal superintendent of stores, and director of ordnance; patterns, systems respecting them; examination of stores. 11. Here will conveniently come in the organisation and duties of the department of the Principal Superintendent of Stores, including the detail of equipments for all services; and proportions of stores, packing ammunition, arrangement of magazines. 12. The last term will be devoted to the manufacture of gunpowder, ammunition, and, generally, the duties of the Royal laboratory, including the chymistry of the subjects—selection and purchase of pyrotechnic material; examination and refining of saltpetre, &c.; gunpowder and powder-mills; theory of gunpowder, qualities, effect of different sized grains; electro-ballistic apparatus, and other modes of proof, gun cotton, detonating compounds, other laboratory specimens, small arm ammunition, cannon ammunition, fuses, rockets, &c.; manufacture of bullets, casting of every description of projectile for smooth bored and rifled ordnance; organisation of the Royal laboratory department; supply of raw material; system of account keeping and payment, prices; relations to the director of stores, director of contracts, principal superintendent of stores, and director of ordnance; patterns, inspection, and examination of stores. 13. The Professor of Applied Mathematics and the several lecturers will proceed in corresponding order through their subjects, so that practical instruction may be based on thorough acquaintance with principles. If found necessary to do so, a large part of the first term will be devoted to theoretical instruction and mathematics, in order that the students may be in a position to follow the professor in the more advanced subjects of his subsequent lectures. 14. There will be periodical examinations and certificates given at the close. 15. No payment will be required. 16. After a certain date, to be fixed hereafter by the Field-Marshal Commanding-in-Chief, first appointments to all special employments of a scientific character will be made exclusively from officers who have passed through the contemplated course of instruction.

THE PAPAW TREE.

At a meeting of the Acclimatisation Society of New South Wales, held in Sydney in August last, Dr Bennett read a paper on the papa or papaw tree (*Carica papaya*), from which the following are extracts:—Visitors to the Sydney Botanic Gardens may have noticed a handsome tree, full six feet high, with large fig-like foliage, on long footstalks, and a melon-like fruit growing from the stem—this is the female tree of the papaya or papaw tree, as to which, for some time, botanists were divided in opinion into what order of the vegetable kingdom it ought to be introduced. By Linnæus it was placed among the *Euphorbiaceæ*, or spurgeworts; by the younger Richard, among the *Passifloræ*, or passionworts; but it now forms the order *Papayaceæ*, and Lindley regards Jussieu's opinion to be correct in considering that the genus upon which this order was founded held a sort of middle station between the nettleworts and cucurbits.

At another part of the garden, at some distance from the female papaw tree, in a soil and situation the most suitable for its successful growth, may be seen a fine healthy male specimen of the same tree (for the papaw tree is generally diœcious—that is, having male and female flowers on separate trees); it is distinguishable from the other by having racemes or panicles of tubular flowers, which spring from the axils of the leaves, and are small, bell-shaped, of a pale-yellow colour, and of an agreeable fragrant smell. The flowers of the female tree have very short foot stalks close to the stem; they are large and bell-shaped, and of a yellow colour. On these perishing the large fleshy fruit is gradually developed. Both these trees have been recently introduced into New South Wales, where they may now be considered naturalised. The fruit is smooth, rather oval, but varies in form, and is about the size of a small melon, resembling the latter fruit in colour when ripe. The central cavity is filled with small, oval, dark-gray seeds, enveloped in a kind of mucus, and which, when chewed, have the pungency and flavour of the Indian cress. The ripe fruit is esteemed by some persons; and the green fruit well boiled, mashed, and sweetened with sugar, and flavoured with lemon-juice, is often used as a substitute for apples in sauce and tarts.

It has been a matter of difficulty to determine the native country of the papaw—both the West and East Indies claim it—there is, however, no doubt of its being indigenous to tropical America, if only from the circumstance of several distinct species inhabiting that continent, while only the cultivated kind is found in the East Indies and Africa. It has been introduced into all tropical countries, and is now even found growing among many of the Polynesian islands. It grows to the height of from fifteen to twenty feet, with a slender, soft, herbaceous stem of small circumference, surmounted by large light leaves, which are supported upon hollow foot stalks, full three feet in length. The bark is rather smooth, pale grey, and has the mark of the fallen leaves. The stem is usually straight, but the female tree in the Sydney Botanic Gardens has two stems growing from one root. It is a tree of rapid growth, and is readily propagated by seeds and cuttings. The tree in the Gardens now bearing fruit is about fifteen months old. The peculiarities of this tree are so remarkable as to merit some notice. The whole of it yields a slightly acrid milky juice, and all parts of the tree are considered efficacious as an external application for the cure of ringworm. The milky juice of the unripe fruit has been found to be a powerful and efficient vermifuge, and the powered seeds have also been recommended for the same purpose, and considered tqually efficacious—a single dose is generally considered o cure, however numerous the worms may be.

Fibrine was considered peculiar to the animal kingdom and the fungus tribe, but it is found that the milky juice of this tree contains it in such quantities as to resemble animal matter, and was found by Sir H. Davy to abound in albumen ; indeed, the resemblance between the juice of the papaw and animal matter was so close as to be suspected as an imposition, if the evidence of its being the juice of a tree had not been quite unquestionable. Water impregnated with the milky juice makes meat washed with it tender, when steeped for only ten or twelve minutes; and the same effect is produced when meat is suspended among the foliage of the tree. It is also mentioned that old animals, when fed upon the uncooked leaves and fruit, become tender and good if eaten soon after they are killed, for the flesh soon becomes putrid. According to the analysis of Vauquelin of the milky juice, 'It most resembles animal albumen, dissolving like it in water. Its solution is coagulated by heat, by acids, alkalies, the metallic salts, and infusion of nut galls ; and by distillation, it yields the same products as animal substances.' Vauquelin also says that a sample of the juice he examined had the smell and taste of boiled beef. Dr. Holder (in the third volume of the 'Wernerian Transactions,' pp. 245-50), who observed the peculiar properties of the juice of this tree in the island of Barbados, says that the effects of the juice, whether of the fruit, stem, or leaves, or even the exhalation from the tree lessens the cohesion of the muscular fibre, and acts on the fibrin of the blood. When the fruit is boiled or cooked in any way, or when ripe, it does not produce the same effect; therefore heat evidently dissipates the active principle on which the intenerating action depends. It is also a common practice in Barbados to administer an infusion of the raw fruit, or rather a diffusion of the milky juice in water for horses, with a view, as it is said, of 'breaking down the blood,' and it is a fact well established, that if given to a horse whose blood exhibits the cupped buffy coat, it will, after some time, produce a loose coagulum, and reduce the inflammatory symptoms which gave rise to it. All the facts produced clearly show that the fruit of the papaw when eaten uncooked evidently acts injuriously on the muscular fibre of animals, for instances have been mentioned of animals that have eaten of the fruit in that state whose flesh has become so much intenerated as to be unpleasant to those who partook of it. The leaves of the papaw are used by the negroes in the West Indies to wash linen instead of soap, and the juice of the pulp as a cosmetic to remove freckles on the skin caused by the heat of the sun.

LIFE-BOATS FOR THE NAVY.

The Admiralty, anxious to provide all cruisers with small life-boats, has asked the officers of the National Life-boat Institution to give plans and superintend the building of a life-boat suitable for a man-of-war, but not to exceed one ton in weight. A trial was made lately with two such boats in the Regent's Canal Docks, in the presence of the Lords of the Admiralty and others. The *Times* gives the following account of the experiment.—One of the two boats tried was 32 ft. long by 8 ft. 10½ in. extreme width, capable of holding, on an emergency, as many as 70 persons, and of accommodating with ease 45 or 50. This boat, however, weighed 37 cwt., or very nearly double what is considered should be the maximum for a handy and useful boat for sudden emergencies. The second boat was 30 feet long, by 7 ft. 4½ in. wide, and weighed only 22 cwt. This would stow with ease 30 persons, and could take off 50 at a pinch. It seemed evident, however, that the Admiralty, in fixing the maximum weight at one ton, have adopted a standard which it will be found very difficult to comply with so as to make a really efficient craft for all weathers. The boats were canted over to the water's edge in every way, and the largest, when emptied, was turned over by means of an hydraulic crane, and though in the still waters of the docks it did not actually right itself, it remained on its side sufficiently buoyant to enable the men to turn it on its keel easily. In dense sea water, and especially in sea water with any swell in it, there is very little doubt it would have righted of itself almost immediately. When it did right, the relief pipes in the bottom, which were opened, allowed the whole load of water in it to run off in less than half a minute. The small boat, though not tested with this severity, was sufficiently proved to show that even when heavily laden with sailors, and the relief pipes and the boat awash to the gunwales, it was still as buoyant and as seaworthy as ever. The result of the trials seemed to show that if the Admiralty will only allow a slight addition to their present standard—say from 20 to 25 cwt.—a perfectly efficient life-boat, fit for any duty in any weather, may easily be obtained. After the trial with the Admiralty boats, one of the Institution's life-boats was shown. This the hydraulic crane had the greatest difficulty in turning over, and no sooner was it brought keel uppermost than it righted itself again, and freed itself of water in the space of 20 seconds. After the trials, the Duke of Somerset expressed his thanks to Mr. Chapman and Captain Ward for the care which they had bestowed in perfecting the boats which were tried.

LUCIFER MATCHES.

Experimental inquiries involving the chemical examination of a considerable number of matches of different kinds, manufactured in London, the Provinces, Germany, and Sweden, have been made by Mr. F. A. Abel, of the Laboratory at the Arsenal at Woolwich, and the result has been given in a paper published in the *Philosophical Magazine* for November. Thirty-five different kinds of matches were examined; these included, besides ordinary lucifer or Congreve matches, varieties of wax or Vesta matches, of cigar lights (fusees, Vesuvians, &c.), and of so-called "safety matches." By far the larger portion of matches are still prepared with ordinary phosphorus ; sulphide of antimony and powdered glass are very general additional constituents of the igniting composition. The matches of several extensive English manufacturers were found to be prepared with an igniting composition containing both ordinary and amorphous phosphorus, the latter being employed in some instances in considerable quantity. Golden sulphide of antimony and powdered glass were found in all the igniting compositions of this class, and a small proportion of free sulphur was contained in several of them. The Congreve and Vesta matches of English manufacture, which are tipped with compositions containing no phosphorus whatever, are unquestionably great improvements upon the earlier continental matches. They are inflamed with ease and certainty when pressed over the amorphous phosphorus rubber on the box ; and the latter does not rapidly deteriorate from the effects of atmospheric moisture upon it, as was formerly the case.

Differences exist between the temperatures at which the igniting material of different matches will inflame spontaneously, and in the degree of facility with which they are ignited by friction and percussion. The order of sensitiveness to ignition by friction or percussion of a match was found to correspond with its susceptibility to ignition by heat alone, in the case of those which contained ordinary phosphorus and chlorate of potassa, provided that glass was included in the composition of the igniting material. Where this was not the case, the matches, though they might be more sensitive to the effects of heat alone than others, on account of the predominance of phosphorus in them, were considerably less so to the effects of friction or percussion. The results of experimental observations prove conclusively that no degree of heat to which, under all ordinary circumstances, matches are likely to be exposed in their transport or otherwise, would suffice to lead to their spontaneous ignition. Even a temperature such as can be attained only under exceptionable conditions by the atmosphere in the hold of a vessel, would not, unaided, bring about the ignition of the more sensitive matches. The effect, however, of even a very moderate degree of heat in facilitating the ignition, by friction or percussion, of mixtures such as those with which the tips of the matches are prepared, is well known. If a box full of lucifer matches, in which the matches, as is very generally the case, are not sufficiently long to fill the box entirely, be subject to repeated concussion, in such a way that the heads of the matches strike repeatedly with some violence against one end of the box, a proportion of the matches will eventually inflame; but the composition upon the head of the match only burns, and the flame generally does not even spread from the head of the match ignited to those immediately surrounding it; so that only isolated matches will be inflamed in a box full with all the heads placed in one direction. If, however, a box of the same matches be exposed to a heated atmosphere (from 27° to 37° C.) sufficiently long for the matches to become warm throughout, the extent to which it will be necessary to submit them to concussion before ignition occurs will be comparatively very slight, and in all probability the whole of the matches in the box will become inflamed almost instantaneously. In common match boxes, with which this experiment has been tried, and which did not close at at all tightly, the wood of the matches was partially burned, and the box itself caught fire at the edges. It is, therefore, within the range of possibility that in the transport of matches on board ship, and in the absence of due precautionary measures, continuous concussion, combined with a degree of heat not unfrequent in the hold of a vessel, may bring about the accidental ignition of lucifer matches—an occurrence which is known to have taken place, and which, it is believed, is much more frequently the cause of fires on board ships than manufacturers and exporters of matches may be disposed to admit.

The author recommends the following precautionary measures with a view to reduce to a minimum the possibility of accidental ignition:—1. The special appropriation, if possible, of some part of the vessel in which matches are transported, to the reception of the packages containing them—or, at any rate, the stowage of such packages together (as far as practicable), distinct from other merchandise of a combustible nature, and in such positions that they may be readily removed in the event of any accidental ignition occurring. 2. The efficient ventilation of that part of a vessel in which matches are stowed. 3. The enforcement of rules on board ship to prevent the possibility of fire being brought by sailors or others into the vicinity of packages of matches. 4. The careful packing of match-boxes into cases, so as to prevent their being subjected to any independent motion by the movement of the vessel. 5. The bestowal of a more uniform attention upon the production of safe and sufficiently stable match-boxes. The metal boxes with hinge lids, in which Vesta matches are most generally packed, rank highest as regards the security they afford to the match, and the circumstance that no accident, however slight, is on record as having attended the shipment of Vesta matches, may stand in close connexion with the employment of such boxes with these particular matches. There are several other kinds of boxes used by manufacturers which are calculated to afford security to the matches, or rather which would do so if their length or height were properly proportioned to the length of the matches. In the majority of instances, however, they are longer or higher than the matches, and sometimes very considerably so; hence, if the latter are not most firmly wedged into the boxes, the construction of these is positively calculated to afford opportunity for submission of the match-heads to concussion. The slide-boxes containing the Swedish matches, which are now largely imported, are all made to correspond in length with the matches they contain. A very extensive importer of these matches states that he had never known of a single instance of accidental ignition occurring in their transport. Many of the boxes roughly constructed of thin chip, which contain the commoner descriptions of English congreves, not only afford but little protection to their contents, but may actually be in many instances sources of danger. Unless boxes of this kind are packed with the greatest possible care, some proportion is almost certain to sustain injury, resulting in the immediate escape of matches from the box. In some instances a piece of well-made glass or emery-paper is pasted on to the bottom of the box, or some fine emery or glass-powder is securely fixed to one of its surfaces by means of glue and coatings of varnish; but in many instances either glass or emery-paper of very inferior quality is used, or the frictional powder is very loosely and carelessly attached to the box by being merely dusted over one of its surfaces, upon which a small quantity of glue has first been applied. In packing match-boxes of this kind, much of the frictional powder will become detached, and further quantities will speedily be rubbed off and be loose in the cases if there is the slightest play for movement of the boxes during transport. The hard angular particles will speedily insinuate themselves into the boxes and between the matches, and contribute their share towards augmenting the possibility of accident.

These remarks do not in any way refer to the matches which are ignited only by being passed over a surface of their box, which is coated with a preparation of amorphous phosphorus. The compositions with which the matches of this class are tipped require very powerful friction or percussion for their ignition, and are, of course, inflamed at temperatures far above that required to ignite the least sensitive of the matches prepared with phosphorus. The possibility of their accidental ignition must therefore be, to say the least, extremely remote. As to the various cigar lights now sold, the author is of opinion that very great risk must be incurred in their transport, and that it is impossible to adopt any precautionary measures which can warrant their shipment with any confidence in the safety of the vessel.

Fine Arts.

Art-Workmen.—A "Quondam R.A. student" writes:—The Commissioners appointed to report upon the Royal Academy proposed that a class of art-workmen should be connected with the Academy, and that those who showed great excellence should receive honorary distinctions, and become members of the Academy. This recommendation Mr. Hawes, the Chairman of Council, in his address to our Society, specially notices as providing a most valuable addition to the art education of workmen. I have too much respect for the judgment of Mr. Hawes not to dissent from this opinion with great reluctance, but his address will give such large circulation to the proposal, and at the same time have such weight with our clever artisans, that he will not object, I am sure, to the expression of a different view of the question:—1st. The schools of the Royal Academy are as unsuited for the proper education of art-workmen as the members of the Academy are to be teachers of the special branches of decorative art appropriate to manufacture, the education of the artist and of the art-workman proceeding on principles entirely distinct. 2nd. There can be no claim whatever upon the members of the Academy, who are the gratuitous teachers of the Fine Arts, to become the teachers of decorative art, even if they are qualified and possess the means for such teaching; but their schools have nevertheless been always wide open to every art-workman who chooses to avail himself of their course of study and has attained the amount of proficiency in drawing required of all who seek to enter them. 3rd. While the Royal Academy is unsuited to the teaching of art-workmen, and is located in the metropolis, where the great branches of manufacture in which skilled artisans are largely employed are not carried on, we have a state institution created specially for their instruction, with a great central school, and branch schools, both in the metropolis and the great seats of manufacture, with masters trained to give the greatest development to the workman's taste and skill—collections of the finest and most costly examples made for his use, and encouragement held out to him by prizes and scholarships to such an extent that for no less than fifteen of the latter offered last year, of the value of £1 per week for one year, with free instruction for that time, there were only four competitors, three of whom alone were selected as barely possessing the rudimental attainments necessary to fit them for the course of study opened to them. Is it not idle, then, to supplement such teaching and such inducements by the crude proposal made in the report of the Commissioners? It seems, indeed, that our own busy Society, by its well devised scheme of prizes to art-workmen, judiciously selecting those works which are calculated to try their powers and test their skill, is doing more for their real improvement and welfare than the jejune scheme of the Commission with its illusory, ill-suited honours.

Burslem Institute.—The award of Mr. Beresford Hope and Mr. Digby Wyatt, as judges of the competition designs "for the decoration of the façade of the Wedgewood Institute in any kind of ceramic ware, coloured bricks, mosaics, and terra cotta," has been made. The first prize of £25, given by Mr. Hope, has been awarded to Mr. R. Edgar, architect, jointly with Mr. J. Kipling, modeller, both of whom were students of the Art Schools in the Potteries. Mr. Edgar is now one of Mr. Gilbert Scott's assistants, and Mr. Kipling is assisting Mr. Godfrey Sykes in the decorative works executing for the South Kensington Museum. Mr. Deville, of London, received the second prize of £15, given by Mr. Heathcote; Mr. J. Ladds, of London, the third prize of £10, given by Mr. Edge, and the fourth, £5, given by the Rev. Dr. Armstrong, was awarded to Mr. E. Power, of London. Mr. Beresford Hope has reason to be contented with this experiment, which he was the first to suggest and promote with his purse and labour.

Great Door at the Capitol in Washington.—This is stated to be a fine work of art, and stands at the entrance of the corridor leading from the old hall of the house to the new. The door is of bronze. The design was by Mr. Randolph Rogers, an American artist working at Rome. The founder was Mr. Frederic Von Muller, of Munich, Bavaria. It is said to be the only work of the kind in the world. Its weight is 20,000lb., and when completed the expense will be about 30,000 dollars. The leading subject of its embellishments is the history of Columbus. It has two valves, with four panels on each valve, and one semicircular panel over the transom. The first panel contains a scene representing Columbus before the council of Salamanca; the second his leaving the convent of La Robida; the third his audience with Ferdinand and Isabella; the fourth his departure from Palos; the semi-circular panel over the transom represents his first landing at San Salvador; the fifth his first encounter with the Indians at Hispaniola; the sixth his triumphant entry into Barcelona; the seventh represents him a prisoner in chains, about to be sent back to Spain; the eighth contains a scene representing his death. There are 16 small niches in the border or frame around the door, in which are statuettes, representing distinguished contemporaries of Columbus, and between the panels are heads representing historians who have written on his voyages from his own time down to the present day, ending with Irving and Prescott. Crowning the door is a bust of Columbus. The ornaments are chiefly emblematic of conquest and navigation. There are also about the edge four statuettes, representing the four great divisions of the world.

Manufactures.

Restoration of Animal Charcoal.—In a beetroot sugar factory at Francières (Oise), a new process, invented by Messrs. Leplay and Cuisinier, is adopted, by which the properties of the animal charcoal are readily restored without having recourse to emptying it from the filters and reburning it. It is stated that at Francières the charcoal has not been taken out of the filters for several weeks, and has each day undergone the process of restoration at a most trifling expense, and with perfect success.

Rifled Guns.—A preliminary trial of Sir William Armstrong's 600-pounder gun, lately manufactured at Elswick for the War Department, was made on the 19th November, at Shoeburyness. The gun weighs over twenty-two tons, and is mounted on an ordinary gun carriage of great size and strength. Its length over all is 15ft., that of the bore being 12ft. Its internal diameter is 13·3in., and it is rifled on the "shunting" principle. The grooves are ten in number, and turn once in sixty-five calibres. In its construction it differs but little from the other large muzzle-loading guns manufactured under Sir William Armstrong's direction, consisting of a number of coiled tubes of enormous strength shrunk one upon the other. The thickness of the walls of the gun at the breech is 20·85 inches, the total diameter at the trunnions being 55 inches. It carries a conical cast-iron hollow-headed shot, weighing 510lb., or a shell of ordinary construction weighing 600lb., and capable of containing a bursting charge of 40lb. of powder. The charge used with shot was 70lb.—with shell 60lb. The gun was served by a party of twenty men. A 9-inch muzzle-loading gun, made at the Royal Gun Factories, Woolwich, and rifled on the plan proposed by Mr. Lynall Thomas, was tried on the 20th November, This gun, which carries a 300lb. shot, closely resembles an ordinary muzzle-loading Armstrong in outward appearance, the muzzle, however, being more prolonged. Mr. Thomas's invention consists in substituting a series of ribs for the usual grooves. The shot are made with grooves coated with soft alloy to fit the ribs of the gun, and are similar in form to those used in the Armstrong, but appear to be slightly longer. The "shunt" principle is not employed by Mr. Thomas. To test the range and accuracy of the gun, ten rounds of cast-iron shot were fired from it at 2° elevation, ten at 5°, and ten at 10°, the charge being 40lb. in every instance. The velocity and range of the shots fired appear to have been very unequal.

Commerce.

Steel Ships.—Two large ships, built of steel plates, were recently launched in the Mersey. Though some small vessels have been built of the same material, this is the first instance in which steel has been used for ocean ships. The steel now manufactured for shipbuilding purposes is said to have an advantage over iron in being more ductile and malleable, as well as stronger and lighter. These qualities bring with them, it is also said, greater economy in building and increased carrying capacity—both most important considerations. Mr. Jones, one of the builders, states that in the *Formby*, one of the newly-launched vessels, of 1,276 tons burden, the weight of steel used is 500 tons, whereas, if she had been constructed of iron, 800 tons of that metal would have been required. In a vessel like the *Warrior*, he declared that by using steel greater strength might be obtained with a saving of one-half in the weight of metal. Mr. Reed, Constructor of the Navy, made a special journey from London to attend the launch and examine the ships. He remarked that merchant ships can be built to test a principle when war ships cannot, as the former can be examined and repaired annually, while the latter are sent abroad for periods of three or four years. He perfectly agreed with what had been said of the importance of steel for the construction of small ships, and stated that the Government took great interest in the question of employing steel as a material for shipbuilding.

BRITISH TRADE WITH JAPAN.—The value of the export trade in British vessels has increased, during the half-year ending the 30th of June last, from £253,337, of the corresponding period last year, to £561,120, and yet, during those same six months, events of an alarming character occurred which were calculated to paralyse any trading operations whatever. The imports in the first six months of this year were £111,470, against £68,931 for the same period of last year, being an excess of £42,489. In this year's returns raw cotton figures for the first time as an article of export, to the extent of 795,207 lbs.

WOOL.—The Circular of Messrs. A. C. Stewart and Co. of Port Elizabeth, Algoa Bay, dated October 11th, says:—"The arrivals of wool from the country districts have been comparatively light, consisting of small parcels of odd lots. We have again to complain of the 'seedy' and 'burry' character of much of the wool brought forward. Prices, on this account, have ruled lower than they would have done. The following are the present prices:—Fine fleece-washed wool, superior, 1s. 2½d. to 1s. 3½d. per lb.; medium, 1s. to 1s. 1½d.; inferior, seedy, and burry, 11d. to 12½d.; coarse, washed, 9d. to 10d.; fine, unwashed, superior, 8¼d. to 8¾d.; average, 7⅛d. to 8¼d.; coarse, unwashed, 6d. to 7d. per lb. The exports during the past month have not been so large. The most remarkable feature in the freight market is, that nearly all the vessels on the berth have been chartered for America, and two more vessels have been chartered in Cape Town to come round and load here for America. The trade this year with our transatlantic cousins will show well when compared with that of previous years."

SUPPLY OF COTTON AND LABOUR.—A "Cotton-Spinner," writing to the *Manchester Guardian*, says:—"I would just point out a few of the principal causes of this scarcity of labour, that its extent may be more easily appreciated. Emigration has taken out to our colonies and other places a considerable number. Many have obtained other employments, for instance—girls have gone into service, and, through the instruction sewing-schools have afforded, others have been enabled to accept situations as seamstresses, &c., from which pursuits it is very doubtful if many of them return. But there is another and a more serious point still than any of the preceding—I allude to the cessation of the ordinary labour supply. When mills are working, children are taken into them and employed, first as sweepers, bobbin carriers, &c., and thus they are being gradually trained to fill the places of those who, from a multitude of reasons, are constantly leaving the work. These are now arriving at the age of full timers; and, through the stoppage of mills, are every day growing up untrained and unskilled, whilst at the same time the causes that usually deplete factories have been going on amongst the old hands. So that, from all these causes together, I cannot help concluding that there will be a very great deficiency of hands when the time comes for resuming work; and, after deliberate consideration, I believe that, could we only have a supply of 35,000 to 40,000 bales of cotton per week for the years 1864 and 1865, that quantity would prove sufficient to find all the factory operatives wanting work full employment. This state of things would secure for the operative a high rate of wages; but it promises, too, I think, a corresponding advantage to the spinner, inasmuch as the curtailed consumption of raw cotton, and consequently a proportionate reduction in the quantity of yarn produced, would have the effect of keeping down the price of the former article, and enhancing that of the latter."

THE VINTAGE OF 1863.—Messrs. R. Symonds and Son, in their trade circular, state that with regard to Champagne the quantity, although less than in 1858, is much greater than in 1861 and 1862. It is difficult at this early period to form a definite judgment of the quality of the wines, but they show every promise of great delicacy of flavour. The Bordeaux vintage, taken as a whole, has been nearly equal in quantity to that of 1862, some of the districts producing more, others considerably less, than last year. In the Palus and "petites Côtes" and other districts producing ordinary wines, the quantity is for the most part greater than in the year previous; but in Médoc, the Graves, and the "Côtes supérieures," the produce is generally less. With respect to quality, they will probably be very inferior to the wines of 1862, and even to those of 1861. The Burgundy vintage, so far as regards the red wines, has been excellent. The wines have a good and deep colour, an excellent bouquet, much aroma, and a perfectly pure taste. They will probably, particularly in the lower growths, prove superior to the wines of 1862. The quantity will be fully equal to that of the last two years. The white wines have generally failed, more especially in Chablis, where repeated hailstorms devastated the larger portion of the vines. The quantities of Hermitage and Rhone wines are somewhat below the average. They will be delicate and of good flavour, but with less body than those of 1862. In the districts more to the south (Château-neuf du Pape, &c.), where the vintage has been somewhat later, it is expected that the quality will prove superior to that of 1862. The quantity in the Roussillon district is considerably below the average, but the quality will undoubtedly be fine. In other parts of the South of France, the vintage, taken as a whole, has been abundant, and the wines will be above the average in point of quality. The Rhine and Moselle vintage, especially in the "Rheingau" is very much later than in France, and is only now in operation. The quantity will scarcely exceed one-third of an average, and the quality will be only mediocre. It may indeed prove better than the vintage of 1860, but will be much inferior to those of 1857, 1858, 1859, 1861, and 1862, all of which are fine wines. It is to be feared, judging from past experience, that the cycle of good years is complete, or near completion, and that we are again about to enter upon a period of inferior vintages. In Madeira, there has not yet been time to learn the quantity produced in the present year, but it is scarcely possible that it can amount to 1,000 pipes in the whole island. Before the outbreak of the Oidïum, in 1852, the average production was 27,000 pipes. As the vines imported from Portugal have not generally succeeded, they are being for the most part rooted up and replaced by native vines in the districts really adapted for the plant. From the nature of the soil, &c., in Madeira, none but old vines will produce good wines, so that it must be yet a very long while before any effectual result can be perceptible as regards exports from the island; but, from the efforts making it is hoped that, in the course of years, Madeira may again produce wines (from the grape) suitable for exportation.

Colonies.

SLATES OF CANADA.—Mr. R. Bell, of the Geological Survey, in a paper on this subject read before the Canadian Natural History Society, says that the annual value of the slates produced in Wales alone is nearly £1,000,000 sterling, and the net profits of many of the companies engaged in this branch of industry are upwards of 50 per cent. The most important slate-producing district in North America is situated in Vermont. But little of the deposit in Eastern Vermont can be profitably worked "owing to contortions, imperfect cleavage, cross joints, and the presence of foreign ingredients." Bands suitable for the manufacture of roofing slate were only found occasionally in this district. The quarries in the western part of Vermont appear to be more productive than those in the eastern part of the state. It seems that this slate is used for other purposes than roofing. Mantel-pieces, table and bureau tops, billiard-table beds, and lamp bottoms are manufactured from it. The slates procured from the Northfield quarries, Vermont, sell at three and a half dollars a "square," delivered in the cars.

In Canada the price is fifty cents less per square, delivered at Richmond. A square of slates is 100 square feet; and the greater the number of slates making up this area, the less the price. The most important slate quarries in Canada occur in the Eastern Townships. Geologically speaking, they belong to rocks of the Quebec group. The author described other probably favourable localities for roofing slates in Eastern and Western Canada.

Dr. WILLIAM GILL, a native of Scotland, who had lived in the Cape Colony for a long series of years, and had led a quiet, unostentatious, but useful life in one of the smaller towns of the coast, died lately. He had been impressed with the want of educational facilities in the land of his adoption, and bequeathed a sum of £20,000 to found a college in the eastern province. The money has been left under such terms and conditions as cannot fail to ensure the efficient carrying out of the benevolent gentleman's intentions.

THE MAHOGANY TRADE.—The price of mahogany is so low in England as well as the United States that it will not pay to cut it. It is said the cuttings in Honduras for the next year will not be more than one-third of the usual quantity, and the same in regard to logwood; so that the chances of trade for the year 1864 are very poor.

CLIMATE AT HOWICK, NEAR PIETERMARITZBURG, PORT NATAL.—An emigrant writes, September 29th, 1863, as follows:—"We are tolerably comfortable out here, though our house has no fence round it, and cattle of various kinds prowl round our kitchen door, and the hens and chickens live in the pantry. The stable is only half roofed in, and we have but a thin iron roof between ourselves and the sky. When it rains, which it does with a vengeance at times, we cannot hear each other speak, and the noise it makes on the roof deadens the sound of the thunder, so our home is anything but a quiet one. The climate here is anything but what we had been led to expect. The thermometer was standing a few days since at 90° in the shade, and within three hours (at 3 p.m.) it went down to 42°, which effectually shut me up for the next 24 hours. The hot winds, too, are very trying, and unhealthy people, suffering from any illness, are frequently carried off if exposed to them at all, and, though sensibly hot, they give cold very readily. There is no doubt, however, that vegetables of different kinds grow here very rapidly, though the more delicate kinds, as peas, &c., soon become hard and tasteless; oranges, lemons, pomegranates, &c., grow in our neighbourhood very fairly; grapes are, strange to say, difficult to ripen; oats grow well; wheat not at all, as it is affected with disease just before ripening."

NATAL.—The export of wool, the great up-country staple, has been considerably in excess of previous years. From the following statistics it will be seen that the value of the shipment of this article has steadily increased during the last ten years:—1852, £2,026; 1853, £3,450; 1854, £3,366; 1855, £8,331; 1856, £7,325; 1857, £9,887; 1858, £11,360; 1859, £23,988; 1860, £27,790; 1861, £32,887; 1862, £38,432; or 905,616 lbs. for last year. The export of wool to the 16th of July, 1863, had reached 905,600 lbs.; value, £37,848. The shipment for this period was, therefore, almost precisely as much, both in quantity and value, as the shipment for the whole of last year. The sugar season is now at its busiest stage, and the forty-seven mills that are scattered along the coast are hard at work. It is too early yet to give anything like a general average of the yield of this year. On many estates, however, between two and three tons per acre are being uniformly obtained. One or two cases have occurred where three tons have been yielded by plots of several acres each. A large crop may be anticipated. 5,000 tons has been estimated as the probable aggregate for the year. In all probability there will be an export of at least 3,000 tons. The want of labour is vigorously urged on all sides, and an increased crop only renders the need greater. Until the coolies that are believed to be on the way arrive, the pressure and inconvenience arising from this cause will be considerable. Welcome as this reinforcement of a thousand labourers will be, more yet are required. A requisition for five hundred more was signed sometime ago by anxious planters, but the government has replied that until more funds are in hand, no further batch can be sent for. There is a growing disposition to be independent, as far as possible, of capricious Kafir labour, and to rely upon imported labourers only. An influx of about 500 Amatongas, belonging to a tribe living north of Zululand is shortly expected, and the distribution of these will afford sensible relief. This demand for labour is a satisfactory indication, in so far as it shows that agricultural enterprise is active. During the last month several mammoth canes have been exhibited, some showing twelve feet of clear cane. Larger specimens are also said to exist. Tobacco is being generally planted in all parts of the colony; its thorough adaptation to the soil and climate induces its extensive growth. Arrowroot continues to be grown to a limited extent, and the favourable prices lately realised in home markets will give a stimulus to this valuable, though badly appreciated, enterprise. Coal has been found in great abundance in the neighbourhood of the Biggarsberg, and it is proposed to establish a line of railway from Durban to the Biggarsberg, up the Umgeni valley. The Union Company is now building a steamer specially adapted for this port. This vessel is 210 feet long, 120 horse-power, and is to draw under eleven feet of water. The *Athens* is also to be placed very shortly between Natal and the Mauritius, an arrangement that would give the colony bi-monthly communication with Europe, and bring it within 35 days' reach of England. Resolutions have been passed approving of about one million acres of Crown lands being thrown open to squatters, in runs of not less than 5,000 acres, and for a period not exceeding ten years, on payment of a small annual fee, and on certain conditions as to occupation and stocking. The necessity of increased European immigration has been affirmed, and a vote of £10,000, instead of £5,000 annually, has been asked for. The immediate introduction of a limited number of immigrants of certain classes has been requested. A proposal to give the Natal Land and Colonisation Company £5 worth of land, at a high upset, for every adult assisted immigrant it lands and receives here, has been conditionally assented to, and certain recommendations with regard to the despatch and reception of immigrants have been made. A historical report, recommending increased taxation of the natives, who now contribute to the revenue yearly two shillings and tenpence, against four pounds ten shillings contributed by the white colonists, has been received, and a general resolution based upon that recommendation has been adopted.

Forthcoming Publications.

PRACTICAL ILLUSTRATIONS OF UPHOLSTERY WORK, being new Designs for Window Draperies, Bed Hangings, Domestic and Ecclesiastical Upholstery, Temporary Decoration, &c., &c. Drawn and arranged by Alfred Standage. (*Atchley and Co.*) The publishers state that, in the examples which will be given, simplicity of arrangement will be a main feature, with due attention to those principles which are the basis of the varied styles of the Mediæval, the Renaissance, Louis XV., and the many other styles now in use for interior decoration. In order to show as much as possible in detail all parts of these designs, they will be published in small folio, so as to admit of their being drawn to the large scale of 1¼ inch, and in some cases 1½ inch to the foot; and the plates, printed on thick paper, will be issued unbound for the portfolio. The work will be complete in four parts, each containing eight plates. Part I., price 10s. 6d., will be published in January, 1864.

Publications Issued.

British Agriculture, by Professor J. Donaldson, Government Land Drainage Surveyor. (*Atchley and Co.*) Price £3 3s. This work contains a geological notice of the formation of the earth; a notice of ancient and modern architecture; treatises on soils and their special cultivation; rotation of crops, &c.; farm implements; animal, vegetable, and mineral manures; irrigation and drainage; animals; the management of grain and root crops, grasses, weeds; the dairy, the orchard, and the garden; farm buildings, fences, gates, and roads, farm accounts, farm agreements, valuations, tables for the purchasing of estates, &c.

Farm Buildings and Labourers' Cottages, with all their details, by G. A. Dean, Agricultural and Engineering Architect. With plates, 4to., price £1 11s. 6d. (*Atchley and Co.*)

Facts and Fallacies of the Sewerage System of London and other large Towns. (*Atchley and Co.*) The writer's object appears to be to give a complete exposition of what he believes to be its defects; showing the pestilence spread by its deposits in the sewers, and the impossibility of removing the matter by flushing; with plans of his own for its purification. Price 3s. 6d., 8vo.

Obituary.

James Beadel, of Gresham-street, and Broomfield-lodge, Chelmsford, died recently. He was one of the founders of the Central London Farmers' Club, to the success and usefulness of which he contributed by his lectures, and he will be remembered as one of the practical agricultural improvers of the day. He was elected a member of the Society of Arts in 1852.

Notes.

Rearing of Plants.—The Municipal Council of Paris have founded an establishment in the Bois de Boulogne, in which plants of every description are reared, and which are afterwards transplanted to ornament the public gardens of Paris. This plantation has lately been increased by an addition which forms altogether a superficies of 4,400 yards. Within this space there are 25 hothouses and 3,000 greenhouses, representing a glazed surface of 10,000 yards. One hothouse is appropriated to palm trees and other tall plants, of which there are at least 2,000. Another hothouse, 500 yards long, covers 250 camellias, and 2,500 fuchsias, of at least 100 varieties, are to be seen in another of 110 yards long. The hothouses are warmed by 22 machines for heating water, and by two powerful calorifères for producing hot air.

The Ludgate-hill Bridge.—A correspondent asks why it is "necessary that Ludgate-hill should be disfigured so entirely as it will be by the plan proposed? Why not have a *crystal bridge?* False sides of embossed and coloured glass, set some inches from the main structure (of course in suitable frame-work), would have a good effect by day, and a pleasing one at night, if illuminated behind."

Hotels.—A prospectus has been issued of the Anglo-Parisian Hotel Company with a capital of £200,000, in shares of £5. The object is to build a large hotel in Paris on the modern principle, "to be conducted upon a much reduced tariff, to meet the wants of the middle classes."

The Albert Institute, Dundee.—A public meeting, to promote the proposed Institute, has been held, Sir D. Baxter in the chair. The object was to erect an Institution, in which it was intended there should be a lecture-room, reading-rooms, library, museum, and a free library and museum for the working classes, should the Free Libraries Act be adopted. The cost was estimated at £20,000, which it was proposed to raise by a joint-stock company, in 2,000 shares of £10 each. Of this sum £10,000 has been subscribed, but there had been no canvass of the general public, to whom it was now proposed to apply. The necessary resolutions were passed. Provost Parker moved that, as the Prince Consort manifested so great and enlightened an interest in the intellectual culture of the nation, it was fitting that the building should be called the Albert Institute. A motion, made by Mr. O. G. Miller, that the establishment of the Albert Institute is a desirable preparation for the reception of the British Association in 1865, was also agreed to.

Railway across the Andes.—A passage is said to have been just discovered near the city of San Fernando peculiarly fitted for a railway, which, by means of the Santiago line, would establish a direct communication between Chili and the Argentine Republic. The Chilian Government have directed a staff of engineers to examine the route.

Hotel Furniture.—A correspondent writes:—"The receipt of our 'Premium List' reminds me of a subject I had intended to write about, viz., the policy of offering reward for new forms of hotel furniture, appliances, and contrivances. Last autumn I noticed some new articles at the Grand Hotel in Paris, and being a shareholder in some of these over-grown palaces, I have an interest in the matter—economy of space, with utility, being most desirable."

Social Science Association.—The Council of this Association have resolved to hold their meeting next year in the city of York. The executive committee was at the same time authorised to carry out a proposed union between the Association and the Law Amendment Society, and arrangements are stated to be in progress calculated to increase the activity and efficiency of the departments, and to secure more definite results from the discussions at the annual meetings.

The Public Lamp Posts at Paris, which are of cast iron, are being coated with copper, by electro-depositing, so as to have all the effect of bronze. The large fountains in the Place de la Concorde have recently been taken to pieces in order to be thus covered. The work is done by M. Oudry, at Auteuil, who is carrying on electro-depositing on a gigantic scale. He has recently completed a full-sized copy in copper deposit of Trajan's column at Rome.

Metropolitan Railways.—Numerous projects have been announced in answer to the suggestions of the committee of the House of Lords of last session. A correspondent recommends that a large map, showing all that is proposed, should be prepared and suspended in the Society's rooms.

Labourers' Cottages.—The attention of the Prince of Wales has been drawn to the bad state of the cottages on his estate at Sandringham. His Royal Highness has evinced a disposition to remedy this state of things, and, after a personal inspection, he gave orders for immediate repairs and improvements to be made.

Prince Consort Memorial.—The site to be occupied by this Memorial is hoarded off in Hyde-park, the spot selected being a plot of turf between Rotten-row and the Kensington-road, exactly opposite the conservatory in the gardens of the Horticultural Society.

The International Exhibition at Vienna, announced to take place in 1866, at present makes no visible progress, because there is no Minister of Commerce. Plans have been prepared for erecting the building on the site of the old fortifications.

Correspondence.

Memorial Tablets.—Sir,—It surely cannot be true that the Board of Works have refused permission to some artists to put up a memorial tablet to Turner

Probably the Board stated that they had no authority. Surely, as the proprietor of a house, I am at liberty to put my own, or my father's, or grandfather's, or even the first father's name on my house if I am so minded. Is it possible the law gives Mr. Thwaites and his colleagues power to prevent my writing up that I am a barber, or any other profession or trade, or that my first cousin was Lord Chancellor born in that house; or must I ask leave and have my roman letters first approved by the Metropolitan Board? If any member can tell what is the state of the law, and will do so, he will oblige A MEMBER OF TWENTY YEARS' STANDING.

LONDON CABS.—SIR,—Why have Paris and Vienna public carriages so much better than London? Is it not on account of the wrong policy which limits the price of the carriage per mile to a fixed sum, and so prevents the competition of excellence beyond what sixpence a mile will remunerate? Why not have carriages at different prices as at Paris? Why should a monotonous price of sixpence per mile be the fixed sum? Why not let cab proprietors send out cabs at 8d. or 1s. a mile, and regulate the quality accordingly? For the protection of the public, it is only necessary to have the price distinctly marked in figures, and perhaps, also, in the colour of the carriage. Why prevent the Londoner from riding in a handsome dark green public brougham, with a good horse, at any price? The Council would do a public service if they would be at the trouble to collect together the experience of great cities abroad, and even Manchester, Liverpool, Birmingham, &c., at home on this subject. I am, &c., F. S.

PARIS.—LOUVRE.—SIR,—Being lately in Paris, I noticed that very extensive atterations have been lately made in the Louvre. Several rooms have been newly decorated and arranged with objects from the Campana collection, and constitute a portion of the "Musée de Napoleon III." The Sauvageot gift is also shown in several rooms. But whilst noticing these changes, I would like to point out to Count Nieuwerke, that visitors, especially strangers, would be under great obligations if directions were given to provide water closets, which although abundantly established in Paris, are not to be found within ten minutes walk of the Louvre galleries. I am, &c., F. S.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Medical, 8½. Dr. C. H. F. Routh, "Diseases of Women and Children."
Royal Inst. 2. General Monthly Meeting.
TUES. ...Zoological, 9.
Syro-Egyptian, 7½. Mr. W. H. Black, "On Roman Mensuration in the Eastern Empire."
Ethnological, 8. 1. "Account of the Weddos, a wild tribe of Ceylon," by a Tamil native of that Island. 2. Mr. John Crawfurd, "On the Commixture of the Races of Man in the New World, as affecting the progress of Civilisation."
Civil Engineers, 8. Continued Discussion upon Mr. Morshead's paper on "Duty of the Cornish Pumping Engines." And, if time permit, Mr. J. M. Heppel, "On the Closing of Reclamation Banks."
WED. ...Society of Arts, 8. Mr. John Chalmers Morton, "Agricultural Progress; its Helps and its Hindrances."
Archæological Association, 8½. 1. Mr. E. Roberts, "On Brixworth Church." 2. Mr. Saxe Bannister, "On Unpublished MS. Lives of Henry V." 3. Mr. Blaslick, "On the Discovery of a Well and other Roman Remains at St. Dunstan's-hill."
THUR. ...Royal, 8½.

Patents.

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GRANTS OF PROVISIONAL PROTECTION.

[*From Commissioners of Patents Journal, November 27th.*]

(Agriculture) pulverising and cleaning the soil, and scattering guano, &c.—2861—J. Walmsley.
Bricks, drain-pipes, &c.—2708—E. Jones.
Charcoal, &c., saturating and cleansing—2855—L. Mackirdy.
Cigars—2831—H. F. Hodson.
Cloth, beetling and finishing—2829—W. Chambers.
Coal, excavating, &c.—2837—T. Harrison.
Cotton gins, &c., driving and feeding—2863—E. Leigh and F. A. Leigh.
Coupling or buckle—2740—B. Blackburn.
Docks, floating and other—2889—J. Elder.
Dramatic effects—2841—B. Hughes.
Fabrics, looped, machinery for—2891—J. Mackew.
Fabrics, woven, singeing—2853—G. Lindemann.
Flour dressing machines—2843—J. Ellison.
Fusees—2811—H. J. Simlick.
Gas burners—2823—W. E. Newton.
Gas-lighting—2800—W. R. Bowditch.
Gun barrels—2887—J. R. Cooper.
Harrows—2752—R. Sellar.
Hydraulic motor—2871—I. Pomès.
India rubber tubes, manufacture of, and covering telegraph wires—2893—J. G. Jennings and M. L. J. Lavater.
Iron, cutting and planing—2735—G. Craven, W. Craven, and J. Craven.
Jacquard machines—2885—R. W. Siever.
Metal plates, bars, and rods, tapering—2770—J. Dyson, J. Dyson, and G. W. Dyson.
Money, tills for—2851—G. H. Courtney.
Mules—2833—E. Spencer and J. Dodd.
Music stools, &c.—2877—F. W. Burton.
Neck ties, &c.—2813—B. Peake.
Ordnance, breech-loading—2879—V. Baker.
Pianofortes—2821—G. H. Brockbank.
Pictures, restoring—2568—M. Petenkofer.
Pipe joints and waterclosets, taps or valves in—2865—S. Cameron and W. Johnston.
Portmanteaus—2859—J. Southgate.
Railroad cars, springs for—2817—G. Davies.
Railway breaks—2798—F. Testuz.
Railway wrappers—2480—D. Lange.
Railway stations, moveable platforms for—2881—W. Pratchitt, J. Blaylock, and J. Pratchitt.
Raising and lowering bodies—2776—C. D. Abel.
Raising heavy bodies, &c., carriages and apparatus for—2825—D. M. Fyfe.
Salt, manufacture of, and boilers to be fed by salt water—2875—R. A. Brooman.
Sewage, liquid, &c., syphons for—2849—G. Barker.
Sewing machines—2764—W. E. Newton.
Ships for war—2895—P. St. G. Græme.
Ships, iron, fouling of the bottoms of—2847—A. Ellissen.
Ships' logs—2599—F. Bullock (Rear Admiral).
Steam hammers—2715—D. Davy, jun.
Steel, casting ingots of—2760—W. D. Allen.
Thrashing machines—2733—W. Audinwood.
Twisting cotton, wool, &c.—2815—A. Illingworth.
Wardrobes—2702—W. Law.
Watches, dead beat independent centre seconds—2827—B. Marriott and C. Radcliff.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Engines, rotatory—2884—J. H. Johnson.
Fibre from *Zostera marina*, &c., extracting—2941—J. Steart.
Grain, preserving—2926—H. A. Bonneville.
Hempen thread, &c., production of, and mixing same with cotton, &c.—2950—St. G. Gregg and T. Gray.

PATENTS SEALED.

1356. F. Patureau.
1371. H. C. Coulthard.
1373. A. Illingworth.
1375. G. H. Cottam.
1377. G. A. Barrett, W. Exall, C. J. Andrewes, & A. Barrett.

From Commissioners of Patents Journal, December 1st.

PATENTS SEALED.

1384. J. Travis.
1389. F. S. Barff.
1393. S. Blake, T. Lee, and R. Dutton.
1394. H. Rigby.
1401. A. Q. de Gromard.
1402. R. A. Brooman.
1404. J. Seaman.
1406. J. H. Johnson.
1439. H. Bessemer.
1449. W. Clark.
1495. I. B. Harris.
1503. W. Mainwaring.
1557. J. Ellison and A. Rogerson.
1597. A. Ripley.
1630. A. Silvester.
2173. C. Jackson.
2237. W. Taylor.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2907. J. S. Manton and T. Inslip.
3002. W. Clark.
3904. I. Sharp and W. Bulmer.
2924. N. Ager.
1827. E. T. Hughes.
2952. J. Ronald.
2957. W. P. Piggott.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2828. L. C. Stuart.
2831. J. L. Clark.